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Morphological Pattern Based Approach for Trademark Retrieval

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***Abstract*— In the current scenario of the economic developments in the world market and growth in the international trade practices, Trademark registration is becoming a critical issue. The number of company and brand is increasing day by day and they all demand a trademark registration for same trade both in the home country as well as in foreign markets. In this paper we propose an invariant approach to break the character and shape of the trademark (logo or design) to capture the shape and related attributes therein to build an efficient trademark retrieval tool. We create the input image in a negative image format for ignoring the background and objects reverse intensities values. The paper illustrates the morphological opening approach for removing the very small objects which can be acting as a noise. The paper also proposes how the extracted images from the trademark database will be matched further for similar input trademarks on the basis of trademark retrieval process from the database.**

***Keywords*— Image trademark retrieval, Image extraction and matching, Morphological patterns and similarity checking etc.**

I. INTRODUCTION

Image processing tools and techniques can be used in solving different problems solving related to image, text, shape and color etc. A Trademark can be a combination of text, image and colored texture and it can be divided in same components for finding similar trademark from the database and for the similarity check up among different trademarks. The problem for the finding the similar trademarks coming is very important because today's world is growing and economic growth caused by trade related practices are in the fast swing at international level. Thousand of trademarks are submitted to every trademark office for their registration for safe business and other trade related aspects. Trademark registration with manual work is very difficult practice for the officials and it needs a practical approach which can be helpful for the same to handle massive trademark databases.

Most of the recent techniques used so far for the image retrieval have mainly emphasized on the features like color, texture, shape etc. They used CBIR technique, i.e. Content Based Image Retrieval systems to retrieve the images based on visual features like texture, color, shape etc [1]. In this technique extraction of color feature uses the color histogram technique and it also considers the shape feature because it's an important feature in CBIR applications. There are many other techniques or approaches which have been applied for the image retrieval. Some are based on improved pattern matching algorithms, others taking a much broader way. Some are based on shape and color feature and some are morphological pattern based for matching and image retrieval from a database. A shape based technique introduced for the logo retrieval is given in the paper [2]. The main objective of our approach is object extraction to improve the results of trademark image retrieval in some predefined sense. There are different shapes and objects combined in a trademark image like characters, lines, image and color etc. To identify these objects, we are breaking them in separate parts.

II. RELATED WORK

Many research groups have been working and facing the challenges for the automatic trademark retrieval. Several techniques have been discussed in a prior art review research paper which covers shape based similarity matching of multi- component images, texture based matching, morphological based similarity matching and retrieval from database, contour and boundary based image retrieval techniques etc.

A. Shape Based Trademark Retrieval : ARTISAN

The ARTISAN project aimed to find a solution of shape based similarity image matching of multi-component images [3]. The architecture of the ARTISAN system requires the basic steps as defined below [4].

- To accept images in an appropriate standard format
- To build up a database of stored image descriptions from these images
- To extract retrieval features from these descriptions
- To allow formulation of visual queries
- To provide efficient and effective matching of query and stored images
- To display query results in an appropriate format.

The figure 1 below shows the input window designed in the ARTISAN system for user's easy access. The input given by the user is processed by the ARTISAN system and the resulting output in the window is given in fig 2 below.

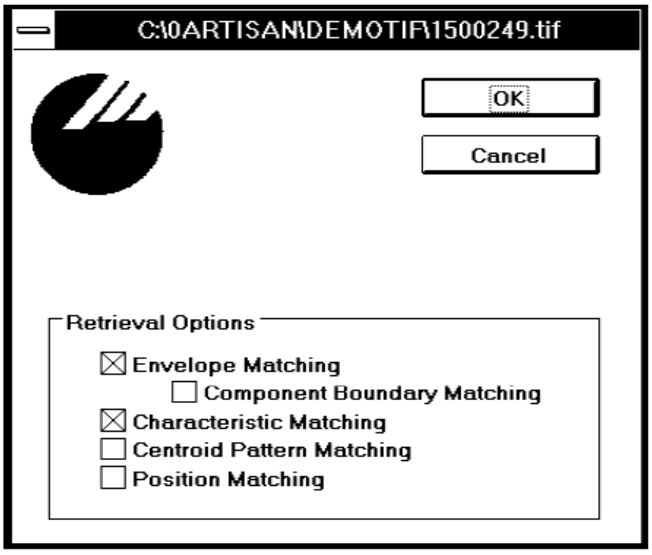

Fig. 1 GUI to accept Input query image for the Trademark retrieval used by the ARTISAN system [3]

Fig. 2 Image retrieval results after input image given in fig1 is processed by the ARTISAN system [3]

The ARTISAN system does not resolve the wider range of image type problems like recognition of the majority of implied shape features.

B. Contour and Region Based Trademark Retrieval

In this method, one considers two prime attributes - contour and region to arrive at similarity measure of two trademarks. The whole system works in two steps. In the first step, contour signature of an input trademark is extracted and used to filter out unlikely matched trademarks from the database. After performing the first step, in the second step, the region feature represented by MPEG-7 ART is used to search the best match from the database of trademarks [5]. In the above mentioned technique of trademark retrieval two main stages; database of trademarks is categorized into 10 classes by contour types. After first contour part process, region based feature extraction and matching is performed. In this stage, input trademark image is first normalized in size. After normalization, trademark is then transformed into 35 moments. Each moment is quantized into 16 bins with a non-uniform quantizer [6]. After then it forms a 35-D feature vector. Now feature vector of the first stage and second stage are compared. After whole process is completed for each potential candidate the output consisting of the similar trademarks are retrieved from the database by the system.

C. Trademark Retrieval Based on Size Function

In this technique, it has been proposed an effective system for Content based trademark retrieval, which involves size functions. Three different classes of shape descriptors are combined, for a total amount of 25 measuring functions. The evaluation of the system has been performed on a database of 1182 trademark images [7]. In the proposed technique trademark retrieval based on size functions has been derived with geometrical topological descriptors, conceived for formalizing qualitative aspects of shapes. First set the definition of size functions (SF's) then describe the set of measuring functions and the similarity score introduced to the scope of trademark retrieval [8].

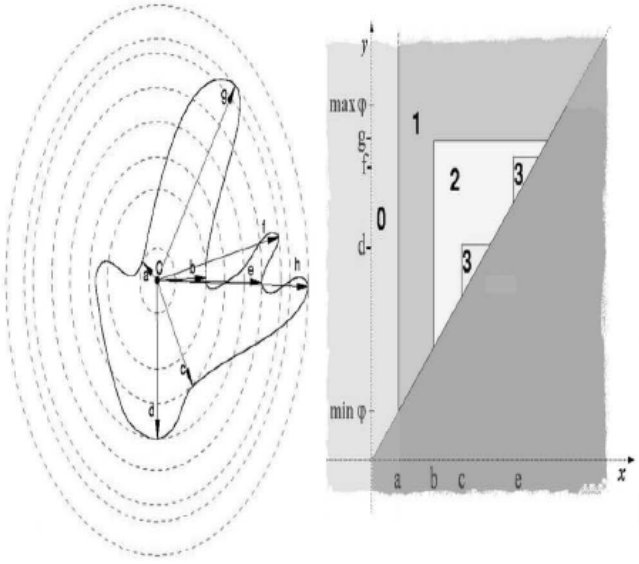

Fig. 3 Shows a simple example of SF. Here, the topological space M is a curve, while the measuring function φ is the distance from point c [7]

III. THE PROPOSED METHOD

A Trademark in general, contains combination of text, image and figurative objects. The proposed work uses an approach different from those used so far. Herein all the combinations of the text and images in the trademark are separated and then arranged in a specific manner to check the similarity index between different trademarks retrieved from the database. Flow diagram for this is given below in Fig 4.

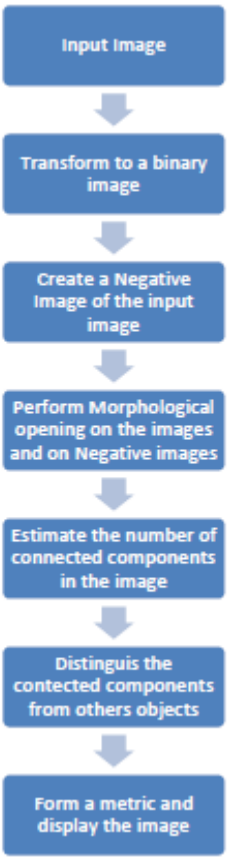

Fig. 4 The process Flow diagram of the proposed approach

Process for the approach

- Input an image by user
- Transform the image to a binary image using im2bw function of the MATLAB.
- Create a negative image of the input image.
- Apply morphological opening on the image as well as on its negative image using bwareaopen function.

Morphological opening of an image helps to remove the very small objects present in the trademarks which can be considered as noise, scattered pixels etc.

- Estimate the number of connected components in the image using bwlabel function. It returns a metric of the input image in a format that consists of values 1 to N, where N is the total number of connected components in the image.
- Enclose each connected component in a rectangle to distinguish it from other objects using regionprops function.
- Decompose the image in various objects found in the image

After getting the metric of connected components, scan the metric in for loop from 1to N, and construct a metric for that object using imagen function. Convert the metric back to the image format and display it.

IV. RESULTS AND DISCUSSION

Accepting the input image and converting it to binary format, a created negative image from the input image is using im2bw function. Figure 5 shows the negative image for a typical input image of NOKIA.

I = im2bw (Input_Image, level) converts the input grayscale image to a binary image. The output image will contain all pixels in the input image replaced with luminance greater than value specified by level with the value 1 as 'white' and replaces all other pixels with the value 0 'black'. The value of the level should be specified in the range (0,1)

Fig. 5 shows the creation of the negative image

The function "bwlabel" is used function to find out the connected objects and define it in a manner-

L = bwlabel (BW, n) returns a matrix L, of the same size as BW, containing labels for the connected objects in BW. The variable n can have a value of either 4 or 8, where 4 specifies 4-connected objects and 8 specifies 8-connected objects. If the argument is omitted, it takes default value as 8.

The elements of L are integer values greater than or equal to 0. The pixels labeled 0 are the background. The pixels labeled 1 make up one object; the pixels labeled 2 make up a second object; and so on. [L, num] = bwlabel(BW, n) returns in num the number of connected objects found in BW. Figure 6 shows the connected objects in a image.

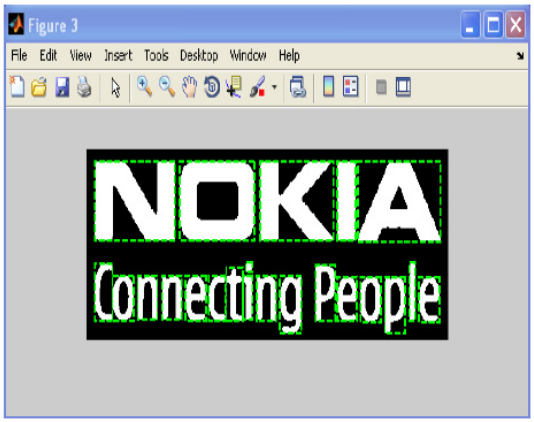

Fig. 6 Shows the connected objects in a Trademark image

After getting the connected objects in the given trademark, input image is scanned for the connected objects in the image and decomposed in terms of all the connected objects in the image. Fig7 shows the input image and its decomposition of the different connected objects present in the image.

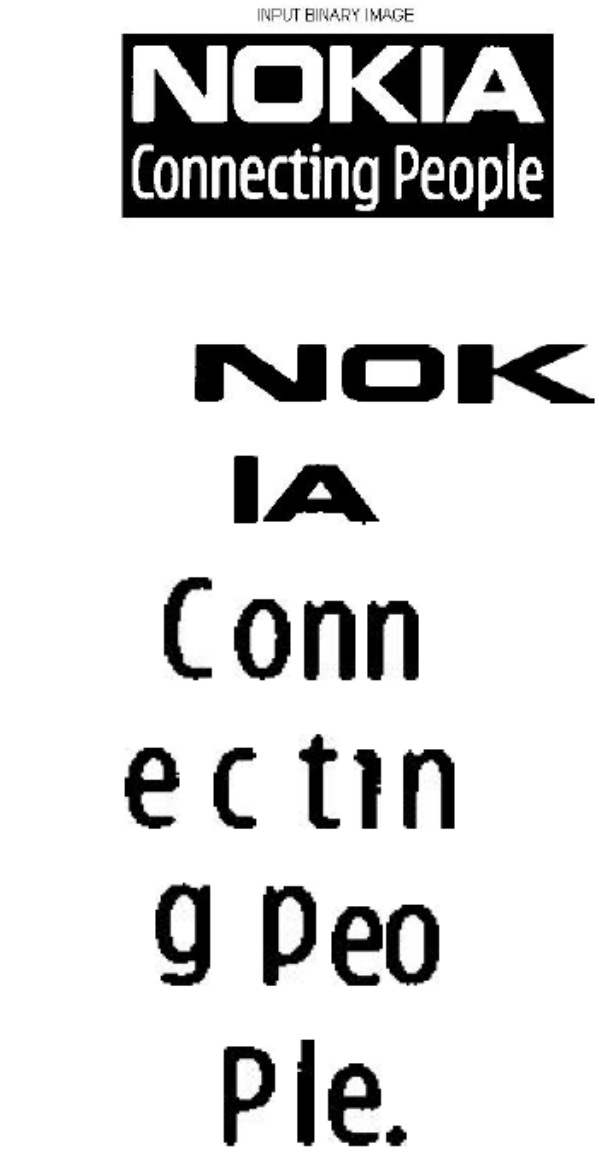

Fig. 7 Showing the decomposition of all connected objects in the given input image.

V. RESULTS AND DISCUSSION

Retrieval of Similar Trademark images is a complex problem and has been tried using different techniques and approaches. The present method is based on decomposition of different connected objects and removal of very small objects using morphological opening technique which represent noise. With this we get all the objects which are connected in a given input image.

The maximum number of objects and images which match with the given trademark are then outputted and user can find out the most similar trademarks which are confusingly similar to decide whether a new trademark be registered or not? Our system arranges the extracted objects which are connected in the input image, in such a way that one can see the objects which is multiple of the in numbers like N is four times, P is two times, O is three times etc. for matching of the maximum number of objects similar in the trademark in a database. After similarity check with extracted connected objects in this way, the system will generate the most similar trademarks in the output section.

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